European Journal of Obstetrics & Gynecology and Reproductive Biology 202 (2016) 75–80

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Review

Cephalad–caudad versus transverse blunt expansion of the low transverse uterine incision during cesarean delivery

Serena Xodo [a], Gabriele Saccone [b], Antonella Cromi [c], Pinar Ozcan [d], Emanuela Spagnolo [e], Vincenzo Berghella [f,*]

[a] Department of Gynaecology and Obstetrics, School of Medicine, University of Udine, Udine, Italy
[b] Department of Neuroscience, Reproductive Sciences and Dentistry, School of Medicine, University of Naples Federico II, Naples, Italy
[c] Department of Obstetrics and Gynecology, University of Insubria, Varese, Italy
[d] Department of Gynaecology and Obstetrics, Bezmialem Vakif University Hospital, Istanbul, Turkey
[e] Department of Perinatal Medicine, Policlinico Abano Terme, Padova, Italy
[f] Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Sidney Kimmel Medical College of Thomas Jefferson University, Philadelphia, PA, USA

ARTICLE INFO

Article history:
Received 11 March 2016
Received in revised form 9 April 2016
Accepted 23 April 2016

Keywords:
Cesarean section
Review
Postpartum hemorrhage
Metaanalysis
Surgery

ABSTRACT

It is imperative to have evidence-based guidelines for cesarean delivery. The aim of this meta-analysis was to evaluate the effectiveness of a cephalad–caudad compared to transverse blunt expansion of the uterine incision to reduce blood loss in women who underwent low-segment transverse cesarean delivery. We therefore performed a systematic search in electronic databases from their inception until March 2016. We included all randomized trials comparing cephalad–caudad versus transverse (control group) blunt expansion of the uterine incision in women who underwent a low transverse cesarean delivery. The primary outcome was postpartum blood loss, defined as the mean amount of blood loss (mL). Two trials (921 women) were analyzed. After the transverse uterine incision in the lower uterine segment with the scalpel, the uterine incision was then bluntly expanded by the designated method. Blunt expansion of the primary incision was derived by placing the index fingers of the operating surgeon into the incision and pulling the fingers apart laterally (transverse group) or cephalad (cephalad–caudad group). Women who were randomized in the cephalad–caudad group had lower: mean of postpartum blood loss, hemoglobin drop and hematocrit drop 24 h after cesarean, unintended extension, uterine vessels injury, blood loss >1500 mL and need for additional stitches. There was no statistically significant difference in the incidence of blood loss >1000 mL, in the operating time and in post-operative pain. In conclusion, expansion of the uterine incision with fingers in a cephalad–caudad direction is associated with better maternal outcomes and, therefore, should be preferred to transverse expansion during a cesarean delivery.

Contents

Abbreviations: CD, cesarean delivery; RCTs, randomized clinical trials; Hgb, hemoglobin; Hct, hematocrit; RR, relative risk; MD, mean difference; CI, confidence interval.

* Corresponding author at: Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Thomas Jefferson University, 833 Chestnut Street, First Floor, Philadelphia, PA 19107, USA. Tel.: +1 215 955 7996; fax: +1 215 955 5041.
E-mail address: vincenzo.berghella@jefferson.edu (V. Berghella).

http://dx.doi.org/10.1016/j.ejogrb.2016.04.035
0301-2115/

Introduction

Cesarean delivery (CD) is one of the most common surgical procedures performed in the Western world and rates are increasing despite efforts to the contrary [1]. It is imperative to have evidence-based guidelines for each surgical step, in order to minimize morbidity and mortality [2,3].

The most common complication of CD is hemorrhage [2]. Researchers have identified the following surgical steps as crucial moments for reducing blood loss during the operative abdominal delivery: use of uterotonics, spontaneous placental removal and blunt expansion of the uterine incision with fingers, rather than scissors [3]. Indeed, compared to sharp uterine incision expansion, blunt expansion is associated with less unintended extensions and favorable maternal outcomes [3]. However, whether the blunt expansion of uterine incision should be performed cephalad–caudally or transversely is still a matter of debate.

The aim of this study was to evaluate the effectiveness of a cephalad–caudad compared to transverse blunt expansion to reduce blood loss in women undergoing a low-segment transverse CD.

Materials and methods

This review was performed according to a protocol designed a priori and recommended for systematic review [4]. Electronic databases (i.e. MEDLINE, PROSPERO, Scopus, ClinicalTrials.gov, EMBASE, Sciencedirect, the Cochrane Library, Scielo) were searched from their inception until March 2016. Search terms used were the following text words: "cesarean," "caesarean", "cephalad–caudad blunt expansion", "transverse blunt expansion", "expansion of uterine incision", "obstetric haemorrhage", "randomized," "randomized controlled trial" and "randomized clinical trial." No restrictions for language or geographic location were applied. In addition, the reference lists of all identified articles were examined to identify studies not captured by electronic searches. The electronic search and the eligibility of the studies were independently assessed by two authors (SX, VB). Differences were discussed and consensus reached.

We included all randomized clinical trials (RCTs) comparing cephalad–caudad (i.e. intervention group) versus transverse (i.e. control group) blunt expansion in women who underwent a low-segment transverse CD. Selection included women undergoing a low-segment transverse CD after 30 weeks of gestation, either planned or urgent. Quasi-randomized trials (i.e. trials in which allocation was done on the basis of a pseudo-random sequence, e.g. odd/even hospital number or date of birth, alternation) were excluded.

After the transverse uterine incision in the lower uterine segment with the scalpel, the uterine incision was then bluntly expanded by the designated method. Blunt expansion of the primary incision was derived by placing the index fingers of the operating surgeon into the incision and pulling the fingers apart laterally (i.e. transverse group) or cephalad–caudad (i.e. cephalad–caudad group). Women in the transverse expansion group had the uterine incision extended by the insertion of both index fingers of the operator into the opening who then pulled the finger apart laterally. In the cephalad–caudad expansion group, a transverse opening of the lower uterine segment was created by separation of the fingers of the surgeon in a cephalad–caudad direction along the midline (Fig. 1).

The risk of bias in each included study was assessed by using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions. Seven domains related to risk of bias were assessed in each included trial since there is evidence that these issues are associated with biased estimates of treatment effect: (1) random sequence generation; (2) allocation concealment; (3) blinding of participants and personnel; (4) blinding of outcome assessment; (5) incomplete outcome data; (6) selective reporting; and (7) other bias. Review authors' judgments were categorized as "low risk", "high risk" or "unclear risk" of bias [4].

Two authors (SX, GS) independently assessed inclusion criteria, risk of bias and data extraction. Disagreements were resolved by consensus with a third reviewer (VB). Data from each eligible study were extracted without modification of original data onto custom-made data collection forms. Differences were reviewed, and further resolved by common review of the entire process. Data not presented in the original publications were requested from the principal investigators.

All analyses were done using an intention-to-treat approach, evaluating women according to the treatment group to which they were randomly allocated in the original trials. Primary and secondary outcomes were defined before data extraction. The primary outcome was postpartum blood loss, defined as the mean amount of blood loss (mL) in case of CD. Secondary outcomes included incidence of unintended extension, uterine vessels injury,

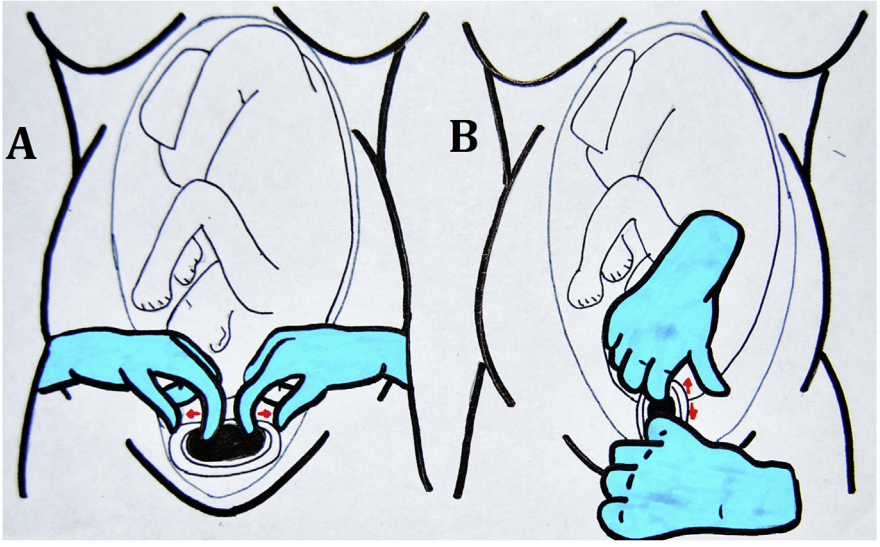

Fig. 1. The transverse (A) or cephalad–caudad (B) blunt expansion of the low transverse uterine incision during cesarean delivery.

need for additional stitches, blood loss >1000 and >1500 mL, hemoglobin (Hgb) and hematocrit (Hct) drop 24 h after CD, mean of operating time (min) and post-operative pain.

The data analysis was completed independently by two authors (SX, GS) using Review Manager v. 5.3 (The Nordic Cochrane Centre, Cochrane Collaboration, 2014, Copenhagen, Denmark). The completed analyses were then compared, and any difference was resolved by consensus with a third reviewer (VB). Statistical heterogeneity across studies was assessed using the Higgins I^2 test. In case of statistically significant heterogeneity ($I^2 > 0\%$) the random effects model of DerSimonian and Laird was managed; otherwise, in case of no inconsistency in the risk estimates ($I^2 = 0$), a fixed effect model was performed [4]. The summary measures were reported as mean difference (MD) or as relative risk (RR) with 95% of confidence interval (CI). Potential publication biases were statistically assessed by using Begg's and Egger's tests. p Value <0.05 was considered statistically significant.

The meta-analysis was reported following the Preferred Reporting Item for Systematic Reviews and Meta-analyses (PRISMA) statement [5]. Before data extraction, the review was registered with the PROSPERO International Prospective Register of Systematic Reviews (registration No.: CRD42015027791) following the PRIMA guidelines for protocols (PRIMSA-P) [6].

Results

The flow of study identification is shown in Fig. 2. Three RCTs were assessed for eligibility [7–9]. One was excluded since blunt versus sharp uterine incision expansion was evaluated [9]. Two RCTs, including 921 women, were analyzed [7,8]. Of the 921 included women, 459 (50%) were randomized in the cephalad–caudad group, while 462 (50%) in the transverse group (i.e. control group). Publication bias, assessed statistically by using Begg's and Egger's tests, showed no significant bias ($p = 0.21$ and $p = 0.34$, respectively). The quality of the studies included in our meta-analysis was assessed by using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions (Fig. 3) [4]. All the included studies had low risk of bias in "random sequence generation." Adequate methods for allocation of women were used in both RCTs. Blinding was considered not feasible methodologically given the intervention, and therefore none of the included studies was double blind. Both authors (AC, PO) of the original RCTs kindly provided additional unpublished data.

Table 1 shows the characteristics of the two included studies and of the 921 included women. No differences were found in the maternal characteristics between the two groups. Both studies came from Europe. In these two RCTs women who underwent a low-segment transverse CD were assigned randomly to have the blunt expansion of the uterine incision by the physician separating the fingers either in a transverse direction or in a cephalad–caudad direction. In the Italian RCT the primary outcome was the incidence of unintended extensions [7], while Ozcan et al. did not pre-specified the primary outcome [8]. All operations were performed under spinal anesthesia and skin incisions were made with a classical Pfannenstiel incision. The two studies had different inclusion criteria: Cromi et al. enrolled all women who underwent a low-segment transverse CD after 30 weeks of gestation, either planned or urgent [7], while Ozcan et al. excluded women with severe medical conditions [8]. One RCT included only singleton gestations [8]. In the Italian trial blood loss was estimated from the blood that had been collected in the suction device, in the plastic pouches of sterile drapes, and in the saturation of pads and sponges [7]. In the study by Ozcan et al. blood loss was estimated using the weight of compresses using during the CD (the increase in weight of compresses with absorbed blood) and the number of intraoperative compresses [8].

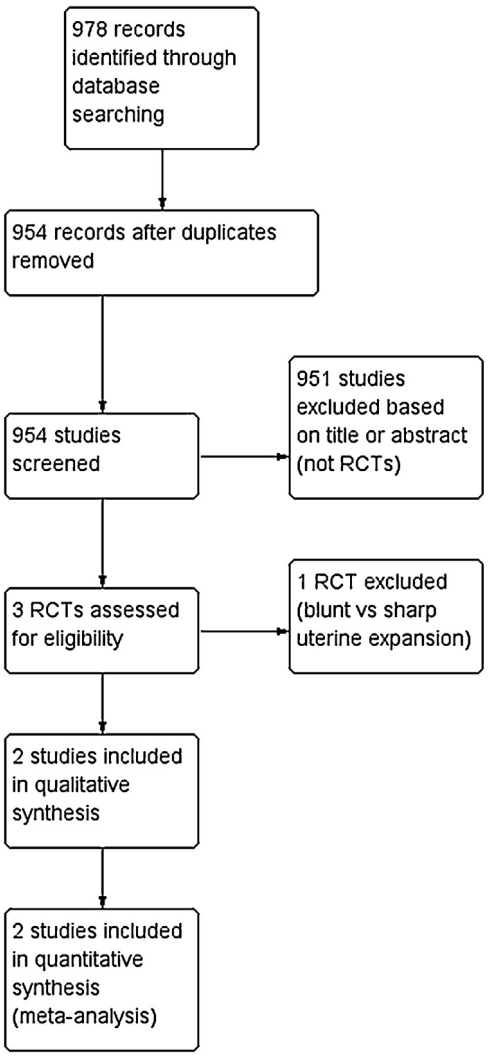

Fig. 2. Flow diagram of studies identified in the systematic review. (Prisma template [Preferred Reporting Item for Systematic Reviews and Meta-analyses]). RCTs, randomized controlled trials.

Table 2 shows pooled results of the primary and secondary outcomes. The statistical heterogeneity across studies was low, with no inconsistency ($I^2 = 0$) in risk estimates for the primary outcome and for most of the secondary outcomes. Women who were randomized in the cephalad–caudad group had lower: mean of postpartum blood loss (MD −67.64 mL, 95% CI −102.85 to −32.43; Fig. 4), Hgb drop (MD −0.26 g/dL, 95% CI −0.37 to −0.14) and Hct drop 24 h after CD (MD −1.20 g/dL, 95% CI −1.87 to −0.53), unintended extension (4.8% vs. 8.9%; RR 0.51, 95% CI 0.30–0.88), uterine vessels injury (1.5% vs. 2.8%; RR 0.52, 95% CI 0.20–0.84), blood loss >1500 mL (0.2% vs. 1.7%; RR 0.12, 95% CI 0.02–0.99) and need for additional stitches (20.3% vs. 29.2%; RR 0.60, 95% CI 0.44–0.82). There was no statistically significant difference in the incidence of blood loss >1000 mL (1.2% vs. 3.0%; RR 0.41, 95% CI 0.14–1.18), in the operating time (MD 1.36 min, 95% CI −0.17 to 2.89) and in post-operative pain (−0.50 points, 95% CI −1.17 to 0.17) (Table 2).

Comment

This meta-analysis from the two high-quality low risk of bias RCTs, including 921 women undergoing a low-segment transverse

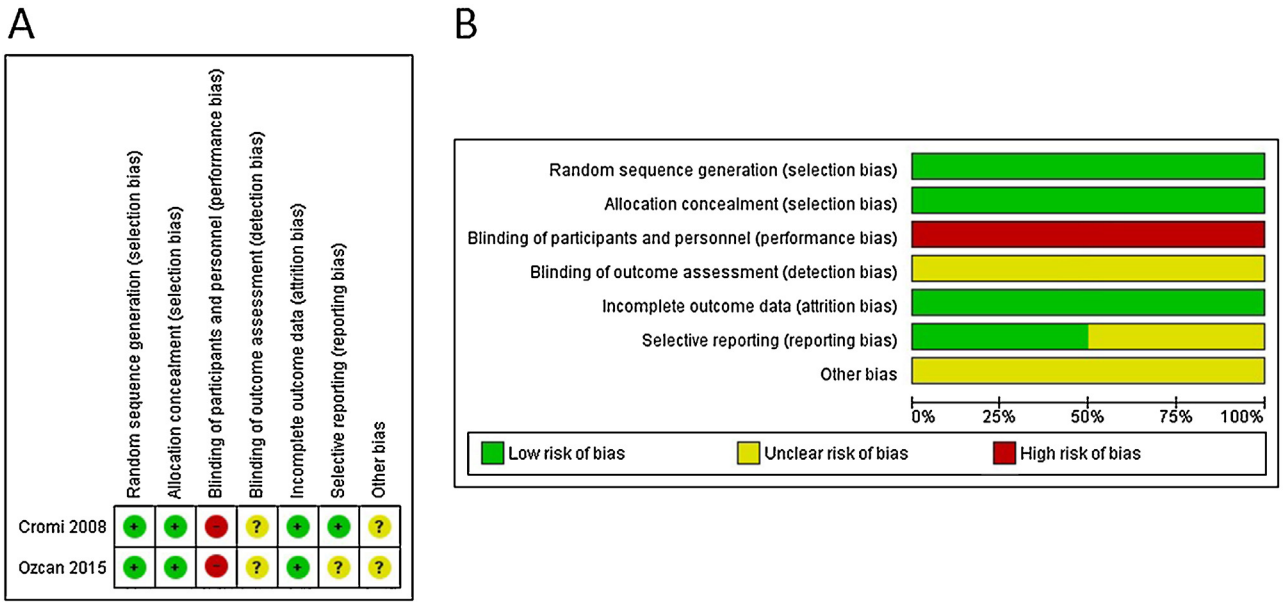

Fig. 3. Assessment of risk of bias. (A) Summary of risk of bias for each trial; plus sign: low risk of bias; minus sign: high risk of bias; question mark: unclear risk of bias. (B) Risk of bias graph about each risk of bias item presented as percentages across all included studies.

CD, showed that cephalad–caudad blunt expansion of the low transverse uterine incision decreased blood loss compared to transverse blunt expansion. It was also associated with lower drop of Hgb and Hct 24 h after CD and lower risk of unintended extension, uterine vessels injury and need for additional stitches.

The comparison of blunt and sharp expansion of the low transverse uterine incision has commonly been discussed in the literature [9–17]. Results from a Cochrane review suggest that blunt expansions should be preferred over sharp expansions because blunt expansions appear to be associated with lower risk of blood loss, shorter operative time, and less unintended extension [17]. It remained, however, unclear which type of blunt technique – cephalocaudal versus transverse – should be used. To our knowledge, ours is the first meta-analysis evaluating the effectiveness of cephalad–caudad compared to transverse blunt expansion to reduce blood loss in women who underwent a low transverse CD.

Our study has several strengths. The two included studies had a low risk of allocation bias by Cochrane Collaboration tool assessment. Intent-to-treat analysis was used, and both random

Table 1
Characteristics of the included trials and of the included women.

	Cromi 2008 [7]	Ozcan 2015 [8]
Study location	Italy	Turkey
Number of patients	811 (405 vs. 406)	110 (54 vs. 56)
Inclusion criteria	Women who underwent a low transverse cesarean delivery after 30 weeks of gestation, either planned or urgent	Singletons without severe medical conditions[b] who underwent a low transverse cesarean delivery
Maternal age	32.6 ± 4.9 vs. 32.7 ± 4.8	30.4 ± 4.6 vs. 29.7 ± 5.6
Parity	0.4 ± 0.6 vs. 0.5 ± 0.7[b]	1.3 ± 1.4 vs. 1.2 ± 1.0
Nulliparous	344 (84.9%) vs. 351 (86.5%)[a]	3 (5.6%) vs. 6 (10.7%)
Primigravida	240 (59.3%) vs. 261 (64.3%)[a]	N/R
Previous CD	104 (25.7%) vs. 90 (22.2%)	42 (77.8%) vs. 46 (82.1%)[a]
BMI	26.7 ± 4.0 vs. 27.3 ± 4.2	28.1 ± 2.3 vs. 28.7 ± 1.8
GA at birth (weeks)	38.3 ± 2.4 vs. 38.5 ± 2.6	38.5 ± 1.1 vs. 38.7 ± 1.1
Labor stage		
Not in labor	274 (67.7%) vs. 296 (72.9%)	49 (90.7%) vs. 52 (92.9%)[a]
First stage	64 (15.8%) vs. 46 (11.3%)	5 (9.3%) vs. 4 (7.1%)[a]
Second stage	67 (16.5%) vs. 64 (15.8%)	0 vs. 0[a]
Indication for cesarean		
Prior cesarean	101 (24.9%) vs. 89 (21.9%)	42 (77.8%) vs. 46 (82.1%)[a]
Dystocia	88 (21.7%) vs. 87 (21.4%)	5 (9.3%) vs. 4 (7.1%)[a]
Fetal distress	87 (21.5%) vs. 91 (22.4%)	0 vs. 0[a]
Malpresentation	57 (14.1%) vs. 62 (15.3%)	7 (13.0%) vs. 6 (10.7%)[a]
Other	72 (17.8%) vs. 77 (18.9%)	0 vs. 0[a]
Fetuses' birth weight	3112 ± 588 vs. 3150 ± 554	3328 ± 517 vs. 3470 ± 518
Fetuses with macrosomia	17 (4.2%) vs. 15 (3.7%)	0 vs. 0[a]
Primary outcome	Incidence of unintended extensions	N/R

Data are presented as total number (number in the cephalad–caudad group vs number in the transverse group) with percentage or as mean ± standard deviation. Nulliparous, no previous vaginal delivery; Primigravida, no previous pregnancy; BMI, body mass index; GA, gestational age; CD, cesarean delivery; N/R, data not recorded.

[a] Additional unpublished data kindly obtained by the authors of the original trials.

[b] Severe medical conditions: diabetes mellitus, moderate-severe hypertension, any blood or thrombophilia disorders, presence of uterine overdistension (multiple pregnancies, suspected macrosomia, polyhydramnios), emergency surgery (placenta abruption, placenta previa), anti-coagulation therapy or a history of other major abdominal surgeries.

Table 2
Primary and secondary outcomes.

	Cromi 2008 [7]	Ozcan 2015 [8]	Total	I^2 (%)	RR or MD (95% CI)
Estimated blood loss (mL)[b]	398 ± 242 vs. 440 ± 341	407 ± 196 vs. 551 ± 179[a]	–	0	**−67.64 mL (−102.85 to −32.43)**
Unintended extension	15/405 (3.7%) vs. 30/406 (7.4%)	7/54 (12.9%) vs. 11/56 (19.6%)	22/459 (4.8%) vs. 41/462 (8.9%)	0	**0.51 (0.30–0.88)**
Uterine vessels injury	0/405 vs. 2/406 (0.5%)	7/54 (12.9%) vs. 11/56 (19.6%)	7/459 (1.5%) vs. 13/462 (2.8%)	0	**0.52 (0.20–0.84)**
Need for additional stitches	93/405 (23.0%) vs. 135/406 (33.3%)	0/54 vs. 0/56	93/459 (20.3%) vs. 135/462 (29.2%)	0	**0.60 (0.44–0.82)**
Blood loss >1000 mL	5/405 (1.2%) vs. 12/406 (3.0%)[a]	N/R	5/405 (1.2%) vs. 12/406 (3.0%)	0	0.41 (0.14–1.18)
Blood loss >1500 mL	1/405 (0.2%) vs. 8/406 (2.0%)	0/54 vs. 0/56	1/459 (0.2%) vs. 8/462 (1.7%)	0	**0.12 (0.02–0.99)**
Hb drop 24 h after CD (g/dL)	1 ± 0.8 vs. 1.2 ± 1.0	0.9 ± 0.7 vs. 1.4 ± 0.7	–	7	**−0.26 g/dL (−0.37 to −0.14)**
Hct drop 24 h after CD (g/dL)	N/R	2.9 ± 1.8 vs. 4.1 ± 1.8	–	0	**−1.20 g/dL (−1.87 to −0.53)**
Operating time (min)	40.4 ± 11.8 vs. 38.9 ± 11.9	42.3 ± 11.6 vs. 42 ± 12.1	–	0	1.36 min (−0.17 to 2.89)
Post-operative pain	N/R	4.6 ± 1.8 vs. 5.1 ± 1.8	–	0	−0.50 points (−1.17 to 0.17)

Boldface data, statistically significant. Data are presented as total number (number in the cephalad–caudad group vs. number in the transverse group) with percentage or as mean ± standard deviation. RR, relative risk; MD, mean difference; CI, confidence interval; Hb, hemoglobin; Hct, hematocrit; post-operative pain, evaluated by the faces pain rating scale 24 h after the operation; CD, cesarean delivery; h, hours; N/R, data not recorded.
[a] Additional unpublished data kindly obtained by the authors of the original trials.
[b] Primary outcome.

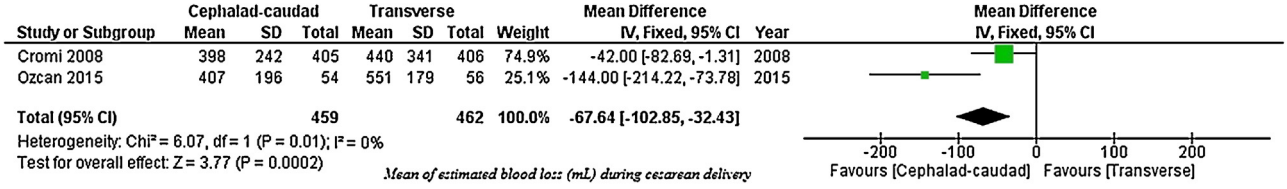

Fig. 4. Forest plot of the mean of estimated blood loss (mL) in case of cesarean delivery. IV, independent variable; CI, confidence interval.

and mixed effects models were used when appropriate. In addition, publication bias was not apparent by statistical analysis. Heterogeneity between studies was variable but generally was not significant. These are key elements that are needed to evaluate the reliability of a meta-analysis [4]. We pooled data from due different RCTs in order to draw conclusions to this clinical dilemma.

Limitations of our study are mostly inherent to the limitations of the included studies. The two trials included had somewhat different inclusion criteria. Given the intervention, none of the included RCTs was double-blind. The outcome parameters were not measured with a valid score. The low number of the included trials and the heterogeneity in terms of rate of prior CD are other shortcomings of this meta-analysis. Another significant concern was the pre-specified primary outcome (i.e. estimated blood loss), which is difficult to measure accurately and consistently, and where the assessor is not blinded to the allocation.

There are clinical scenarios which were not addressed in the included RCTs. These include, as examples, a small low uterine segment (e.g. in preterm gestations), the presence of myomata at the level of the uterine incision, placenta previa or accreta, or uterine dehiscence. In general, we would speculate that cephalad–caudad expansion would still be feasible and preferred in most (if not all) of these scenarios, but more data is needed for a definite answer. The long-term risks of previa or accreta or other complications in a subsequent pregnancy according to the type of uterine expansion were also not reported in the included RCTs.

The lower uterine segment consists of circular and transversely running muscular bundles. This anatomical feature explains why the uterine incision can be easy widened. When the surgeon expands laterally the uterine incision, he actually applies a separating force to the cleavage planes between the muscular bundles. In order to avoid the consequence deriving from the lack of control of magnitude's force and the following unintended extension with possible uterine vessel injury, the cephalad–caudad expansion has been proposed. Our meta-analysis showed that cephalad–caudad blunt expansion of the low transverse uterine incision decreased blood loss compared to transverse blunt expansion. The biological plausibility to explain our findings is not completely clear. However, the supposed advantage of the cephalad–caudad approach might be the control of the expansion, thus avoiding the damage of lateral uterine and parametrial blood vessels.

In summary, expansion of the uterine incision in a cephalad–caudad direction is associated with lower risks of postpartum blood loss, unintended extension, uterine vessels injury and need for additional stitches, and should therefore be preferred to transverse expansion when a CD is performed. Further studies are required concerning subsequent pregnancies, e.g. risk of scar dehiscence during a vaginal birth after cesarean, risk of placenta previa/accreta in the next pregnancy.

Funding

No financial support was received for this study.

References

[1] Martin JA, Hamilton BE, Osterman MJ, Curtin SC, Matthews TJ. Births: final data for 2013. Natl Vital Stat Rep 2015;64:1–68.
[2] Berghella V, Baxter JK, Chauhan SP. Evidence-based labor and delivery management. Am J Obstet Gynecol 2008;199:445–54.
[3] Berghella V, Baxter JK, Chauhan SP. Evidence-based surgery for cesarean delivery. Am J Obstet Gynecol 2005;193:1607–17.
[4] Higgins JPT, Green S. Cochrane handbook for systematic reviews of interventions, version 5.1.0 (update March 2011). The Cochrane Collaboration; 2011, Available at: www.cochrane-handbook.org [accessed 20.02.15].

[5] Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. J Clin Epidemiol 2009;62:1006–12.
[6] Shamseer L, Moher D, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ 2015;349:g7647.
[7] Cromi A, Ghezzi F, Di Naro E, Siesto G, Loverro G, Bolis P. Blunt expansion of the low transverse uterine incision at cesarean delivery: a randomized comparison of 2 techniques. Am J Obstet Gynecol 2008;199:292.e1–292.e16.
[8] Ozcan P, Ates S, Guner Can M, Yardımcı AS, Batmaz G, Kilic G. Is cephalad–caudad blunt expansion of the low transverse uterine incision really associated with less uncontrolled extensions to decrease intra-operative blood loss? A prospective randomised-controlled trial. J Matern Fetal Neonatal Med 2015;25:1–5.
[9] Rodriguez AI, Porter KB, O'Brien WF. Blunt versus sharp expansion of the uterine incision in low-segment transverse cesarean section. Am J Obstet Gynecol 1994;171:1022–5.
[10] Magann EF, Chauhan SP, Bufkin L, Field K, Roberts WE, Martin Jr JN. Intraoperative hemorrhage by blunt versus sharp expansion of the uterine incision at cesarean delivery: a randomized clinical trial. BJOG 2002;109:448–52.
[11] Hidar S, Jerbi M, Hafsa A, Slama A, Bibi M, Khairi H. The effect of uterine incision expansion at cesarean delivery on perioperative hemorrhage: a prospective randomized clinical trial [in French]. Rev Med Liege 2007;62:235–238.
[12] Sekhavat L, Dehghani Firouzabadi R, Mojiri P. Effect of expansion technique of uterine incision on maternal blood loss in cesarean section. Arch Gynecol Obstet 2010;282:475–9.
[13] Asıcıoglu O, Gungorduk K, Asıcıoglu BB, Yıldırım G, Gungorduk OC, Ark C. Unintended extension of the lower segment uterine incision at cesarean delivery; a randomized comparison of sharp versus blunt techniques. Am J Perinatol 2014;31:837–44.
[14] Xu LL, Chau AM, Zuschmann A. Blunt vs. sharp uterine expansion at lower segment cesarean section delivery: a systematic review with metaanalysis. Am J Obstet Gynecol 2013;208:62.e1–e8.
[15] Saad AF, Rahman M, Costantine MM, Saade GR. Blunt versus sharp uterine incision expansion during low transverse cesarean delivery: a metaanalysis. Am J Obstet Gynecol 2014;211:684–8.
[16] Dahlke JD, Mendez-Figueroa H, Rouse DJ, Berghella V, Baxter JK, Chauhan SP. Evidence-based surgery for cesarean delivery: an updated systematic review. Am J Obstet Gynecol 2013;209:294–306.
[17] Dodd JM, Anderson ER, Gates S, Grivell RM. Surgical techniques for uterine incision and uterine closure at the time of caesarean section. Cochrane Database Syst Rev 2014;7. CD004732.